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# Sealing economy: Exploring seals as resources in the Åland islands ca. 1100-1700 CE through zooarchaeology and account books

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## 1. Introduction

The Åland Islands is an island group in the northern part of the Baltic Sea located between mainland Finland and Sweden (Fig. 1). The Islands saw important social and cultural changes with the transition from the Late Iron Age (ca. 700-1050 CE), Medieval period (ca. 1050-1500 CE) and up to the early modern period (ca. 1500-1700 CE). Archaeological excavations of the Late Iron Age settlement sites and cemeteries have provided important insights into the lifeways and subsistence economy. Analyses of the assemblages show that the subsistence economy was varied and flexible and based on the utilization of many domesticated and wild mammal resources as well as fishing (e.g. Storå et al., 2012; Gustavsson et al., 2014). The Late Iron Age farmsteads appear to have been more or less self-sufficient and indications of trade and export or import of food stuffs are limited (e.g. Storå et al., 2012; Gustavsson et al., 2014). Few medieval and early modern period settlement sites in the Åland Islands have been excavated. It is possible that some settlement sites interpreted as Late Iron Age are actually from the medieval period (Gustavsson et al., 2014). Ethnographic records of the later periods show that the location of the islands and the archipelago setting has resulted in varied subsistence strategies and differences in how foodstuffs were obtained. Cultivation was mainly focused on the larger islands while the vast archipelago provided rich resources and possibilities for fishing, fowling and seal hunting (e.g. Ahlbäck, 1955; Storå, 1985; Núñez, 1995).

Seal hunting was carried out extensively and grey seal (*Halichoerus grypus*) and ringed seal (*Phoca hispida*) were important prey (Storå and Ericson, 2004; Storå and Löugas, 2005; Storå et al., 2012; Gustavsson et al., 2014). The late Iron Age assemblages also include harp seal (*Phoca groenlandica*) which seems to have disappeared following the early medieval period (Storå and Löugas, 2005; Storå, 2010). The harp seal has also been identified in other Late Iron Age assemblages in the Baltic area (Storå and Löugas, 2005; Storå, 2010). The grey seal and ringed seal are found in the area around the northern Baltic Sea region, even today (Ukkonen, 2002).

The livelihood of the medieval period is described in a few medieval

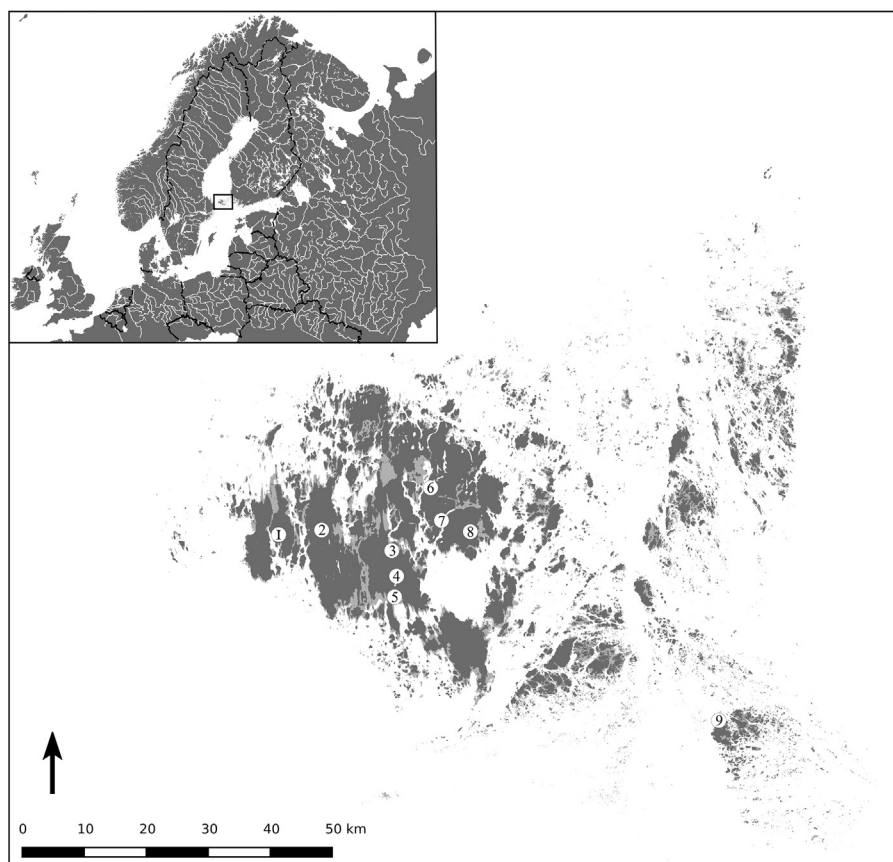
texts while the later historical periods are better known from rich ethnographic and tax records (e.g. Ahlbäck, 1955; Storå, 1990). Our knowledge of hunting in the medieval and early modern periods on Åland is limited and still largely based on descriptions in records of fines and account books (e.g. Ahlbäck, 1955). Up to 1809 CE, the islands were part of Sweden, as with the rest of Finland, which means that for a long time the accounting system was the same as in Sweden. The 16th century tax records, as well as 18th century ethnographic publications on Åland mention that grey seal, ringed seal, and possibly common seal (*Phoca vitulina*) were hunted (e.g. KA, 2608; 2638; Radloff, 1795). The latter species is not present around the islands today but is found in the southern parts of the Baltic Sea (Härkönen et al., 2005). Only few zooarchaeological studies cover the seal hunt and use of the animal in the Baltic Sea in the early modern period (e.g. Herva and Salmi, 2010).

We may anticipate that hunting patterns for seals were affected by an increased legislation of hunting rights. The tithe (sw. *sältionde*) on seals is probably one of the oldest ones recorded in the Åland Islands. At least since the Middle Ages the Church took a tithe on captured seals. A letter from King Magnus Eriksson dated 10 August 1335 states that one tenth of captured seals, which had previously gone toward the building foundation of the parish churches, were now to be used by the parish vicar (MUI nr. 426). The tithe was reinforced by letters from Archbishop Peter and the Bishops of Turku, Bengt and Hemming (MUI nr. 432, 438, 475). The tithe in the outer archipelago island of Kökar was collected by Franciscan friars, who also had the right to a toll on all fish, mainly cod, caught at the nearby fishery of Mörskär (Bertell, 1953). When the friary was dissolved after the Reformation, the tithe and fish privileges were overtaken by the Crown (Bertell, 1953; Sjöstrand, 1993). The Crown, in this case, was represented by the castle of Kastelholm, founded on the largest island in the late 14th century.

The castle functioned as a defence centre but also held administrative functions, such as collecting the Crown's taxes from the islands and reported income and spending of the castle to the king's scribes (Almquist, 1917; Hallenberg, 2001). The seal tithe appeared in the castle account books after 1552 (KA 2634), as well as occasional extra

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**Fig. 1.** Map of the Åland islands. The sites analysed in this study are marked in red and numbered. 1 = Kyrkoby (Eckerö), 2 = Kattby (Hammarland), 3 = Brömsängsbacken (Jomala), 4 = Parsonage (Jomala), 5 = Mariehamn 5 (Mariehamn), 6 = Kohagen (Saltvik), 7 = Kastelholm Castle (Sund), 8 = Finby (Sund), 9 = Franciscan friary (Kökar).

taxes. The accounts cover the island of Kökar, also regarding extra taxes, because the Crown only took over the friary and the privileges the brothers previously were entitled to. In addition, in Ostrobothnia, where seals were caught in large numbers for commercial purposes, the tithe was transferred from the Church to the Crown in the mid-16th century (Kvist, 1987).

Seal products such as blubber (and train oil) and hides were the primary reason for seal hunting from an economical point of view. These were the products people could make money from but also pay taxes with. Meat, entrails and blood on the other hand were mostly for individual use, and not so much for sale (Hellbom, 1987). The Catholic Church prohibited eating meat during lent, which was the best season for seal hunting (Ylimaunu, 2000). In medieval Sweden seals could, however, be regarded as fish if they escaped into the water when hunted (Magnus, 1555). An account book from the late 15th century for the castle at Stegeborg (on the east coast of Sweden) mentions that seal meat was served only prior to Easter (Alvered, 1999). In contrast, in Denmark and Norway, seals were not regarded any differently from other mammals (Ylimaunu, 2000).

The present paper aims to explore the significance that seals held for the people in the Åland Islands during the medieval and early modern period in light of zooarchaeological analyses of bone finds and available written documentation. More specifically, we investigate when and for which purposes seals were hunted and which seals or parts of seals that were transported to Kastelholm Castle. The two data sets provide different possibilities and complement each other (e.g. Kivikero, 2017, 2019a,b). This was done by studying zooarchaeological assemblages from four different types of medieval and early modern sites and the Kastelholm Castle account books from the mid-16th century and tax records for Åland. These findings are contrasted with the results of zooarchaeological analyses from five Late Iron Age sites to examine possible chronological differences in the hunting patterns after the Iron Age.

## 2. Material and methods

### 2.1. Zooarchaeological assemblages

In the present paper we study seal exploitation patterns based on zooarchaeological assemblages from four medieval and early modern settlement sites on the Åland Islands: a castle, a parsonage, a friary and a farmstead (Fig. 1). The parsonage in Jomala was in use from the mid-13th century to the mid-16th century (Hörfors, 1988, 1992; Carlsson, 1993) while the castle at Kastelholm was established in the late 14th century and was used until the end of the 18th century (Palamarz, 2004). The Franciscan friary dates from the 14th to the 18th centuries (Gustavsson, 2005) and the farmstead in Eckerö dates to the 17th century (Gustavsson, 2009). These sites will be compared with five Iron Age sites dating to ca. 400-1100 CE with published data (Storå et al., 2012; Gustavsson et al., 2014).

The zooarchaeological material analysed from Kastelholm consists of 143 kg of unburned bones. The assemblages were studied by using the reference collection of the Osteoarchaeological Research Laboratory at the University of Stockholm. The seal bones discussed in this paper are concentrated in an area of a few square meters just outside the castle walls (Carlsson, 1987). The farmstead in Eckerö had 5 kg of bones and the parsonage in Jomala contained 28 kg of animal bones (Gustavsson, 2003). The Franciscan friary on the outer archipelago island of Kökar includes 81 kg of animal bones and the mammal bones were analysed by Tal Fischer (Fisher, 1996). In this paper, on the basis of metric data, we will provide new data on the seasonality and age structure of the seals from the friary.

The five Late Iron Age assemblages of Kattby, Mariehamn, Finby, Brömsängsbacken and Kohagen have been published by Storå et al. (2012) and Gustavsson et al. (2014). The sites of Brömsängsbacken and Kohagen have also been discussed in an unpublished Master's thesis (Kennebjörk, 2014). The sites serve as comparative material (Table 1).

**Table 1**

The total number of fragments in the studied assemblages in comparison with the Number of Identified Specimens (NISP) and the respective NISP count for seal bones. %NISP for the seal was calculated from the total NISP.

Date (CE)	Site	Tot frag	Tot NISP	Seal NISP	%NISP Seal	Harp seal	Grey seal	Ringed seal	Common seal	Unspecific seal
1450–1700	Friary (Kökar)	6368	3645	315	5%					315
1350–1600	Kastelholm (Sund)	38,411	31,758	423	1%				18	340
ca 1600	Kyrkoby (Eckerö)	4793	561	87	15%		1	2		84
1250–1500	Parsonage (Jomala)	11,631	7513	8	0,1%					8
820–1280	Kohagen (Saltvik)	13,176	8734	397	5%	14	1	2		61
800–1100	Brömsängsbacken (Jomala)	9326	9006	526	6%	22	26	1		477
880–980	Kattby (Hammarland)	16,373	9444	970	10%	x	27	10		933
650–980	Mariehamn 5 (Mariehamn)	1537	703	65	9%	24		1		40
390–900	Finby (Sund)	2925	1118	425	38%	15	7			403

Brömsängsbacken and Kohagen are large settlement sites with several building structures, Kattby and Mariehamn are farmstead sites while the finds from Finby were mainly recovered in and around a heap with fire-cracked stones, but without a special association to settlement remains.

The zooarchaeological and taphonomic analyses on the bone material were done according to standard methods and techniques in the identification of species and skeletal element and anatomical representation, age and sex assessments, and identification of butchery marks. Standard references used were Habermehl, 1961; Silver, 1969; Grant, 1982; Vretemark, 1997; Outram, 2001, 2002; Storå, 2002; Magnell, 2006; Lyman, 2008. The identification of seal bones was done by comparison to reference material, but also according to morphological criteria described in e.g. Storå (2001) and Hodgetts (1999). Here we report the results of the quantifications according to the number of identified specimens (NISP) which is here considered to be the most suitable analytical unit. NISP was counted in this study from identified species and family. Units such as minimum number of individuals (MNI) or minimum number of elements (MNE) would not have provided more reliable estimates (see e.g. Lyman, 2008). Osteometric analyses were only made from the Franciscan friary.

## 2.2. Account books from Kastelholm castle

The castle of Kastelholm was an administrative centre for the Swedish Crown in the Åland Islands. One of the purposes of the castle was to collect taxes from the peasants of Åland. Only a few account books in Sweden have been preserved from the period prior to the mid-16th century (Hammarström, 1956; Myrdal, 1996), none from Åland. After that the number of documents increases rapidly. This study includes account books from Kastelholm Castle and tax records for the Åland Islands. The records, held in the National Archives of Finland and Sweden, were studied between 1539 and 1557 and from 1568 to 1569. The earliest mentions of seals in these records are from 1546.

## 3. Results

### 3.1. Seal hunting patterns

The relative frequencies of seals vary considerably between sites (Table 1). The highest frequency of seals from the medieval and early modern periods was noted at the farmstead in Eckerö (15%) while the frequency at the parsonage in Jomala was only 0.1%. Of interest is the rather different frequency of seals at Kökar (9%) and Kastelholm (1%), both representing tax collecting units. The chronologically oldest site at Finby stands out with the highest frequency, which could be due to the possible differing use of this site. The Late Iron Age settlement sites and farmsteads exhibit frequencies of seal bones between 5 and 10%.

All the medieval and early modern sites had two seal species in common: grey seal and ringed seal (Table 1). Ringed seal is more abundant at Kastelholm than at the Late Iron Age sites. Although

species identifications are not available for the whole material from the friary, a rough estimation can be gained through the osteometric analyses. The measurements were done from 22 humerus of grey seal and 30 of ringed seal. The number of humerus identified for the analysis, although limited, indicate a larger number of ringed seals than of grey seals in the friary assemblage. A few elements at Kökar might come from common seal but it was not possible to identify this with certainty.

Grey seal and ringed seal are mentioned in the account books alongside a species referred to as *morungar* (Table 2). *Morungar* also appears in 18th century books on natural history of the Archipelago Sea and Åland and in ethnographic descriptions (e.g. Radloff, 1795; Hellbom, 1987). The Swedish Academy's Dictionary of Words (SAOB, 2019) states that it is a seal species, sometimes used to refer to common seal. In light of the osteological analyses, it is plausible that the species in question is common seal, which does not at present occur further up the Baltic Sea than the coast of Öland (Jensen, 2004).

The age distribution based on epiphyseal fusion shows that there were animals from all age groups at Kastelholm and Kökar, from pups to old individuals (Fig. 2). The number of bones on the other sites was too small to allow interpretations on the age structure. The epiphyseal fusion data is difficult to interpret in exact terms, but a few general differences are noteworthy. The age assessments at Kastelholm and Kökar indicate that few animals appear to have been recently born prior to the hunt but still approximately half of the seals on both sites were sub-adult seals (Fig. 3). This is suggested not only by the level of fusion of the long bones but also by the fusion of the vertebral discs (around 43%, not shown) which fuse to the vertebral bodies when the seals are adults (Storå 2001). From the comparison it is evident that the frequency of young seals less than one year of age (AG1) is higher in the assemblage from Kökar than in Kastelholm (this is seen as a lower frequency of fusion in AG1 on Kökar than at Kastelholm, Fig. 2).

The level of fusion in the age groups AG2-4 (juvenile to old adult) is higher at Kökar indicating a higher incidence of older seals (Fig. 2). Kastelholm lacks elements of old adult seal but the small number of elements has to be considered here which affects the comparisons. The higher frequency of bones from old adult seals at Kökar is in line with the level of fusion in AG2 and AG3 and indicates that the assemblage seem to contain element of old adult seals, which also affects the pattern on the younger age groups. This means that there is a higher frequency of bones from old subadult seals at Kastelholm than on Kökar.

Size comparisons of skeletal elements were possible only at Kökar. The size comparison of humerus, for both ringed seal and grey seal, shows that the youngest pups seem to be missing but instead the assemblages has a high representation of older yearlings of both ringed seal and grey seal (Fig. 3). Measurements of extant seals are used as comparison (see e.g. Storå, 2002). This implies that the seal meat in the friary and historic period parsonage comes from seals hunted in late spring and throughout the rest of the year.



**Table 2**

The number of seals hunted annually by the castles seal hunters and what seal products were transported to Stockholm. It is also shown which products are shown in the accounts to be taken of the seals. Sources KA 52; 2608; 2611; 2612; 2613; 2617; 2618; 2619; 2620; 2626; 2630; 2634; 2635; 2638; 2643; 2648; 2650; 2662; 2663.

Hunted seals	1546	1547	1548	1549	1550	1551	1552	1553	1554	1555	1556	1557	1569	Total
Greyseal ( <i>Halicoerus grypus</i> )	1	6		6		18	24	12	15	4		11		97
Ringed seal ( <i>Pusa hispida</i> )	3	10	17			80	50	52	56	46		46		360
"morungar"	3	12	23	42		48	30	45	47	45		35		330
Seal pup						2		9	1					12
Seal ( <i>Phocidae</i> )				14	75					2	139			230
Total	7	28	40	62	75	148	104	118	119	97	139	92		1029

products of seal	↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓													
	K= <i>klimpetran</i> '	K	K	K	K	-	-	K	K	-	-	T	T	T
T= tran oil	-	-	T	-	T	-	-	-	-	T	T	T	T	-
B= blubber	B	B	B	B	-	B	-	B	B	B	B	-	B	-
S= skins	-	S	S	S	S	S	S	-	S	S	-	S	-	
M= meat	-	M	M	M	M	M	M	M	M	M	M	M	-	

Transported seal products	1546	1547	1548	1549	1550	1551	1552	1553	1554	1555	1556	1557	1569
train oil				x	x	x			x			x	
" <i>klimpetran</i> "		x	x	x			x	x					
Blubber		x		x		x	x	x	x			x	
Skins: seal					73	13 dec./71 skins			9 dec./2 skins			7.5 dec.	
Skins: ringed seal and "morungar"			3										
Skins: ringed seal			20	14									
Skins: "morungar"			6	7									
Skins: grey seal				32									
Skins: seal pup											11		

3.2. Seal hunting and seal exploitation in the account books

The tithe collected to the castle Kastelholm included seal blubber, train oil and skins, i.e. items that would not be visible in the zooarchaeological record. The number of seal skins delivered to Kastelholm from Kökar varied annually between 2 and 3. However, in 1552 only blubber was delivered. The castle also collected an extra tax on blubber and train oil between 1552 and 1554 (KA, 2634; 2638; 2643; 2648; 2650; see also Kvist, 1987). These taxed products were also the ones which had a wider market value that stretched to central Europe (Kerckonen, 1959) but as mentioned they would seldom leave traces in the archaeological assemblages. According to the account books, peasants from Kökar delivered meat as tithe to the castle only in 1556. The same year the castle received meat from six seals from an undescribed source (KA 2650).

The accounts show that the castle employed their own hunters. They were employed for 6 to 7 months a year, but it is not recorded during which months (KA 2618; 2623). The seal hunters would obtain seal skins, blubber but also meat for Kastelholm (Table 2). The number of seal hunters employed by the castle varied from year to year. In 1548 and 1549 the accounts show that four seal hunters received an allowance from Kastelholm, and in 1552 and 1557 the number was 8 hunters (KA 2618; 2623; 2635; 2661) indicating that the hunting efforts varied in intensity. This corresponds to an increased number of seals caught by the hunters from seven to 148 between the years 1546 to 1557. This might be due to an increased interest from the Crown to exploit seals as a resource. It is also possible that more seal hunters were employed because the ice conditions were optimal for seal hunting several years in a row.

The products utilized from the captured seals vary (Table 2). It is implied in the account books that meat was taken from all these seals; but an exception is shown for the year 1546, when no meat at all was used (KA 2608). In addition, in 1550 only meat was taken from 40 seals (KA 2626). In some years, seal skins seem to have been damaged while cutting off the blubber and the skins had to be discarded due to the resulting defects. In 1554, as many as 8 skins were discarded (KA 2643).

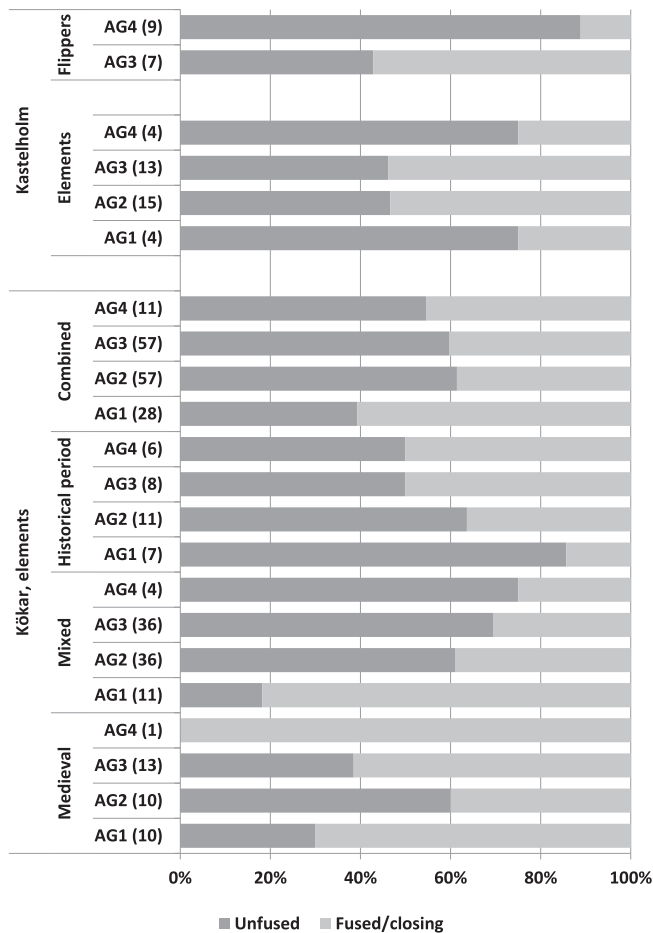
The account books show that blubber, train oil and hides were also transported from Kastelholm mainly to Stockholm Castle (Table 2), but also to Turku Castle and to the landed estates associated with Kastelholm (e.g. KA 2651; 2663). Amongst the products shipped to Stockholm was '*klimpetran*' which is understood to be some kind of lumpy train oil (SAOB).

3.3. Seal meat consumption and utilization of the body parts

It seems that at least between 1547 and 1557 seal meat was consumed at both the bailiffs' (and professionals') table and the workers' table at Kastelholm (Table 3). In the weekly food register of the castle in 1568 seal meat is absent (KA 2785). Blubber occurs in the food register, although it is not evident whether it was used as food or in food preparation (e.g. KA 2635; 2643; 2799). On some occasions it cannot be determined from the accounts at which table the foodstuffs were consumed, only that it was consumed.

The records in the account books suggest that whole carcasses were brought to the castle. The zooarchaeological assemblages with seal bones come from a few square meters outside the castle walls which show that seals were handled and processed in a specific area. The bones may be food waste, but they could also be remnants of the dismembering of seals when the meat was removed and prepared for preservation. Seal meat is found in the lists of consumed foodstuffs and it was recorded under salt fish (e.g. KA 2617; 2626; 2643; 2662). The salting of seal meat and blubber is also mentioned in the register of salt use (e.g. KA 2623; 2638; 2663). The meat was most probably cut into pieces and preserved in barrels.

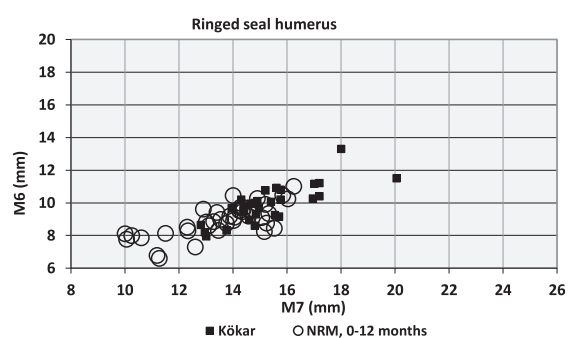
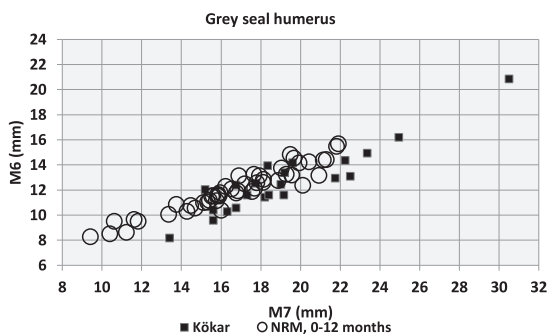
The osteological analyses show that most anatomical regions of the seals are present in the castle assemblage, although comparatively few elements from the flippers compared to other anatomical regions (Fig. 4). The flippers of the seals were not common in the assemblage at Kastelholm. The same kind of pattern can be seen in the other medieval and early modern sites, but the parsonage in Jomala has altogether too few bones to make comparisons. Intriguingly, the flippers are better represented at the Late Iron Age sites but also in the early modern



**Fig. 2.** Age distribution based on epiphyseal fusion data of long bones, pelvis and scapula for seals at Kökar and long bones, pelvis and scapula and separately toe- and finger bones of the flippers at Kastelholm. Note the small number of elements in many age groups (AG) in parentheses. AG1 = yearlings, AG2 = juveniles, AG3 = young adults and AG4 = old adults, see [Storå \(2001\)](#). Unfused elements come from seal younger than age groups in question and a fused element comes from a seal from the age groups in question or an older one. Data for Kökar from [Fisher, 1996](#).

farmstead in Eckerö.

Chop marks were documented in 48% of the seal bones in Kastelholm, most of them in the 16th century context ([Fig. 5](#)). Chops were found mainly on ribs (costae) and vertebrae. The chops on ribs show that the bones (and meat cuts) were divided into smaller pieces, as was done also with the vertebrae, but not so much to divide the animal into specific and standardized sections.



**Fig. 3.** Size comparison of the humerus of grey seal (left) and ringed seal (right) from Kökar compared to measurements of extant seals between 0 and 12 months of age (at the Natural History Museum, Stockholm). Measures according to [Storå and Ericson \(2004\)](#).

**Table 3**

The use of blubber (B) and meat (M) for consumption in Kastelholm. Sources: KA 2612; 2618; 2620; 2626; 2635; 2638; 2643; 2651; 2661; 2663; 2799.

Place	1549	1550	1551	1552	1553	1554	1556	1557	1569
Bailiffs table	B M	M		B M	B	M		M	
Workers table			M	B M	B M			M	B
Castle (no table)	B M	M	B M	M	B M	B M	B M	B M	
Kitchen									B

#### 4. Discussion

The representation of the seal species implies that a chronological change occurred in the hunting patterns for different seals between the Late Iron Age and the early modern period. This may reflect both as a change in the ecological conditions for the seal populations around Åland but also a preference of the hunters. Harp seal, which earlier had been identified in the Late Iron Age assemblages, is missing in later zooarchaeological assemblages and also in the account books. On the other hand, for the first time the common seal is identified in zooarchaeological assemblages from this time period so far north in the Baltic Sea.

It is possible that the reason for the common seal to disperse northwards could be related to climatic factors such as a warm period or be due to an increased availability of fish in the area. Common seal feeds mainly on gadids and herring, especially cod ([Jensen, 2004](#)) which is found in the faunal assemblages from Kastelholm and Kökar ([Krooks, 2016](#); [Kivikero, 2019b](#)). The size of populations of fish species, such as herring and cod, in the Baltic Sea is influenced by inflow of saline water from Kattegat and Skagerrak. One possible reason for the increase of saline water is the Medieval Climate Anomaly, which lasted until ca. 1400 CE ([Kuijpers et al., 2012](#)). Saline water can also enter the Baltic Sea if sufficiently long periods of low air pressure and strong westerly winds blow towards the area ([Carlsson, 1997](#): 13). Such a change could be linked to the more northerly dispersal of the common seal compared to the conditions at present.

The change in species representation could also have been associated with the right to hunt for seals, which may have been more regulated after the Iron Age. The waters in the inner archipelago were bound to the rights of the owner of the land, while the open waters were free to everyone for hunting, fowling and fishing ([Ahlbäck, 1955](#); see also [Kivikero, 2019b](#)). This could mean that the grey seals, which most often remain far out towards the open seas as well as breed at the margin of the fast ice, could be hunted more freely compared to the ringed and common seals. The latter tend to stay closer to islands and bays and hunting would probably have needed the permission of the land owner.

Ethnographical accounts describe long hunting expeditions by the hunters in Ostrobothnia in the Northern Baltic in the late winter and

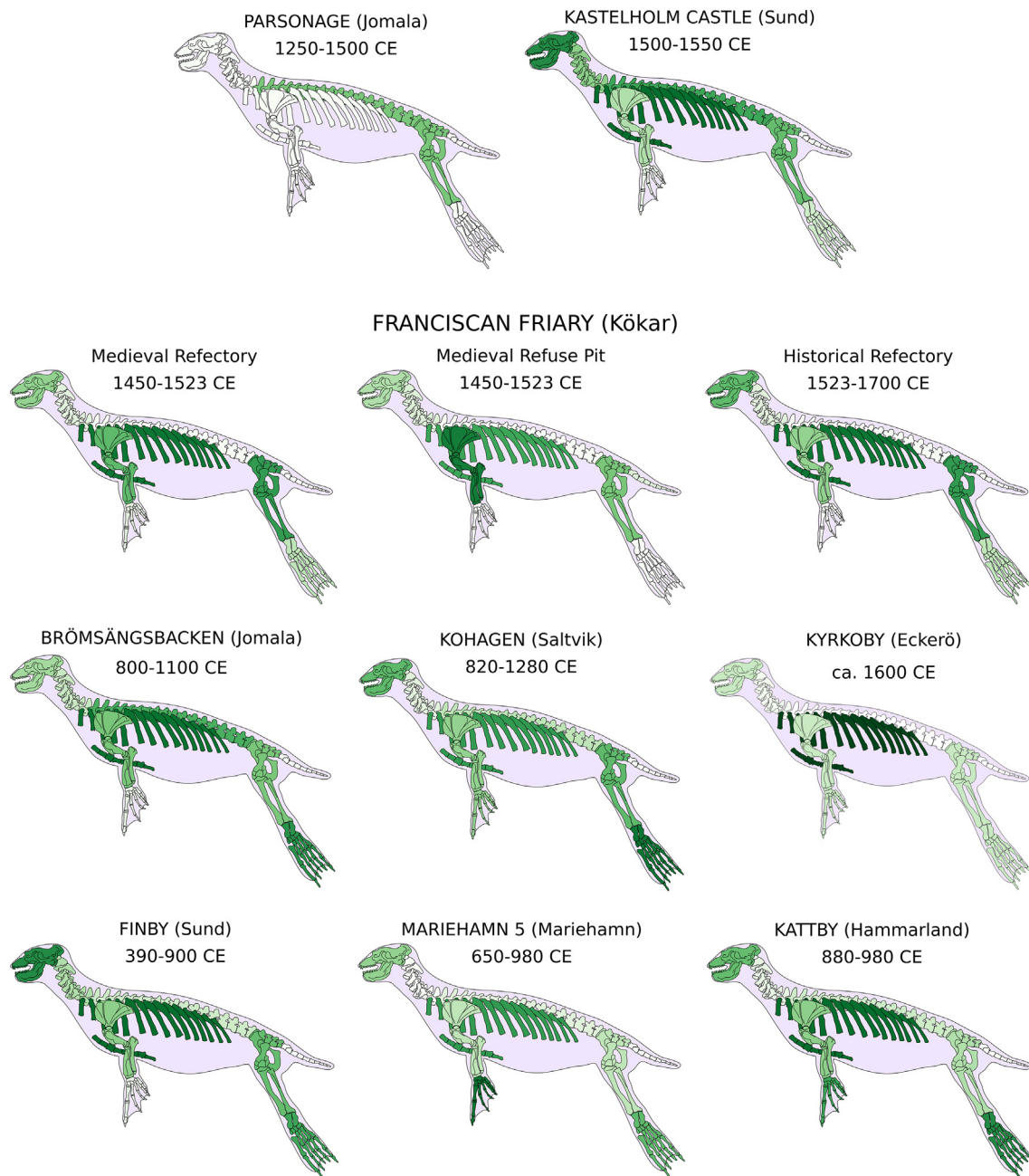


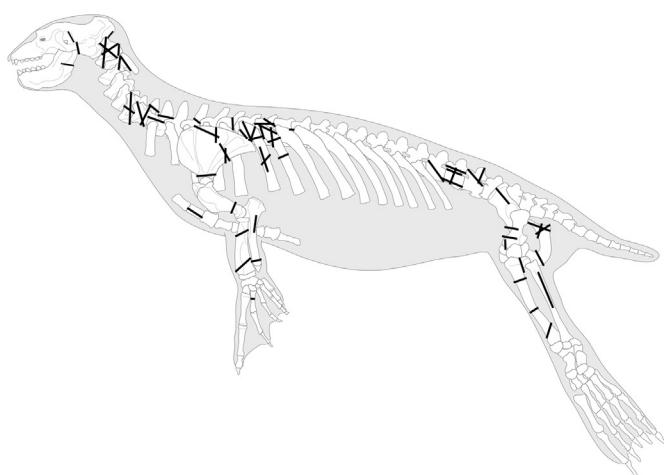
Fig. 4. The anatomical distribution of seal bones settlement sites in the Åland islands shown in NISP. Base image for seal by Michel Coutureau, ©ArchéoZoo.

early spring to exploit the (grey) seals that were having pups at the margin of the fast ice (e.g. Ehnholm, 1930; Storå, 1990; Edlund, 2000). According to Andersson (1931) this was not the case on Åland as the seal hunters (in groups) would travel a couple of days to the edge of the ice sheet where the grey seals would have drifted on pack ice (Fig. 6). Ringed seals, on the other hand, are able to keep breathing holes open in fast ice and the pups spend the first weeks of life in a lair in the ice (Jensen, 2004). The seals could be found closer to the islands than grey seals. Ringed seals could be clubbed on ice and also be hunted with seal nets that were fixed under the ice (Andersson, 1931; Ahlbäck, 1955).

The age pattern of the seals indicates that the seals were hunted all year round. The hunting was probably to some extent related to the taxes that the hunters had to pay since the tax collection and tithe were mainly paid with blubber and skins. The blubber layer of the seal is thickest in early- and mid-winter, and thinnest in summer. In late spring the seals (grey seals and ringed seals) change their fur, which devalues

the fur during this period (Ylimaunu, 2000). Also, based on the size comparisons from the friary in Kökar this does not seem to have been a common hunting period of seals. However, the account books do not describe whether the skins had to be of a specific quality, or whether a specific quantity of blubber per seal was expected. This means that it is possible that the peasants could deliver skins of poor quality or smaller quantities of blubber if the seals were hunted during summer. However, as most of the skins and blubber were transported to Stockholm, it is possible that the Crown expected a high quality, as was expected with foodstuffs (e.g. Kivikero, 2019b).

The hunting periods seem to have been interrupted by two protection periods, one before St. Matthew's day (February 24th) and the other before St. Peter's day (June 29th). The dates in the Julian calendar are roughly two weeks later in the Gregorian calendar, which is used today (Fig. 6). The protection periods are known to us because they were not always respected. Records of fines reveal that in 1537,



anatomic region	element	15th cet.	16th cet.	17th cet.	Total
cranium	occipitale		1		1
	zygomaticum		2		2
	temporale		2		2
	mandibula		3		3
backbone	atlas		4		4
	axis		4		4
	ve.cerv.	2	14	4	20
	ve.thor.	1	18	7	26
	ve.lumb.		14	2	16
	ve.indet.		3		3
	coxae		8	1	9
	total				
rib cage	costae	6	59	17	82
	sternum			1	1
font extremity	scapula	2	4		6
	humerus		2		2
	radius			1	1
	ulna		3	1	4
front flipper	mc II		1		1
	ph 2, ant.		1		1
	femur		3	1	4
rear extremity	os cruris			1	1
	tibia		5		5
	fibula		2	1	3
rear flipper	calcaneus		1		1
total		11	154	37	202

Fig. 5. The placement of cuts to seal and the relationship of cuts and chops in the anatomy in Kastelholm. Base image of seal by Michel Coutureau, ©ArchéoZoo.

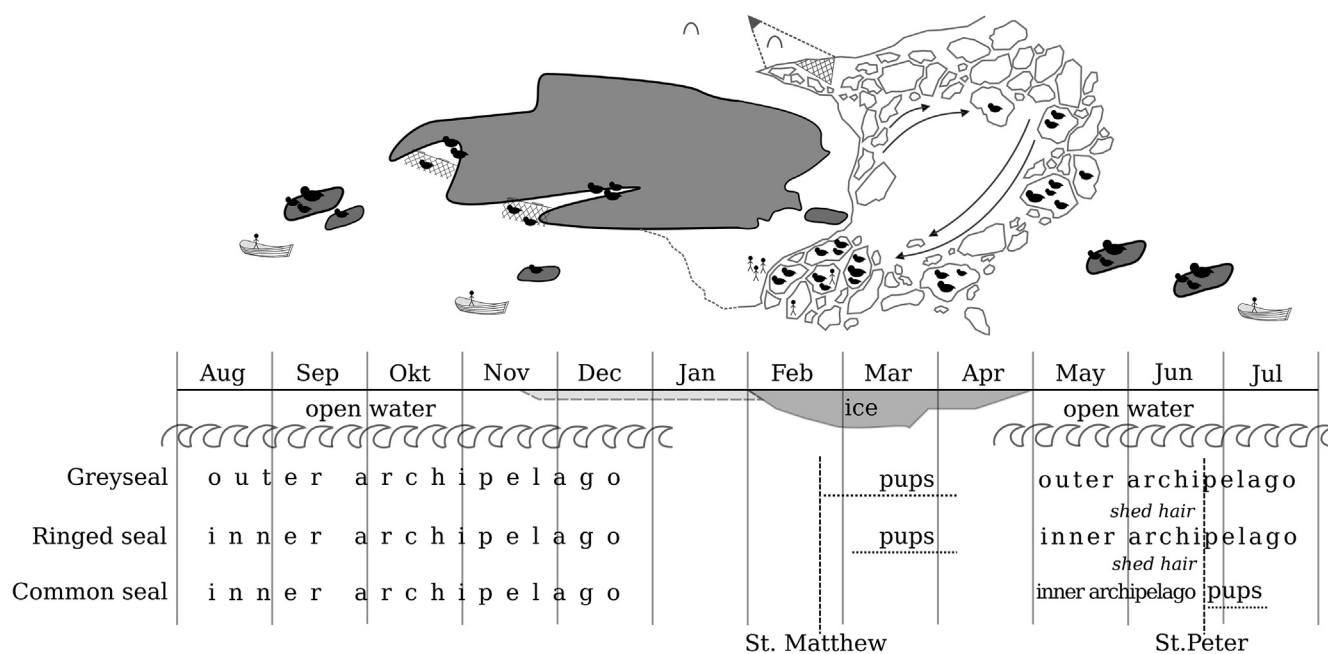


Fig. 6. Hunting patterns of seals and the saints' days mentioned in records of fines as protection periods.

1549 and 1550 peasants were fined for laying seal nets before or on St. Peter's day. In 1544 peasants were fined for catching two old seals before St. Matthew's day (Hausen, 1894: 3, 30, 74, 80, 85).

It seems the first protection date was related to the protection of pregnant females of both ringed and grey seal to ensure that the pups would be born and protected during their first weeks of life. The protection period during the summer might be associated with the common seal which at the present time breeds on land in the summer months (Härkönen et al., 2005). If disturbed, the seal could abandon the pup and it could move long distances (Ylimaunu, 2000). The sources do not reveal how long the protection periods were, but it is possible that, outside those periods, seal hunting would occur at least between 9 and 10 months a year, i.e. longer than when seal hunters in the castle were employed. The effect of the protection on the seal population is difficult to evaluate, but it probably affected the hunting pattern in general, and

the fines mentioned above show that the regulations were not always followed.

From the account books of Kastelholm it cannot be determined when the seal meat was consumed, only that it was served. The preserved meat could be consumed at the castle outside of the hunting season. It is noteworthy that the period of lent was conveniently one of the most favourable hunting periods of both the ringed and grey seals as the sea was still covered with ice.

In the zooarchaeological assemblages from Kastelholm there is a high frequency (ca. 50%) of sub-adult seals that are small in size and would provide small amounts of blubber per seal as well as small skins. How this would have affected the tittle is not known, but the young seals would have provided meat of better quality than that of old seals, which could taste of train oil. The meat in the flippers was regarded as one of the best parts of the seals, alongside the heart, liver, kidneys,



udder and the head (Hellbom, 1987). This difference in general quality of meat could be a reason for the high incidence of young seals at both the castle and the friary, where the meat of the younger seals was desired for consumption, and not the meat of old seals.

The account books show that seal meat and blubber were salted and the meat was preserved in barrels. The carcasses needed to be chopped into smaller sizes in order to fit into the barrels. The marks seen on the bones show that a rather crude cutting (chopping) was used. The reason for the dominance of parts from the back bone and rib cage, i.e. the trunk, at Kastelholm and also at the friary might be that these parts contain relatively large amounts of meat and small amounts of fat so that the meat would not spoil as easily when preserved (Harald, 2006).

The relatively high number of bones from flippers in the Late Iron Age sites compared to the younger sites could be due to how the seal was divided and also utilized. Ethnographic accounts from Åland describe that seals could be divided after the hunt so that the person responsible for the kill of the animal could claim the head and the flippers as a reward, especially when the whole animals were dragged to land and not divided on the ice (Ahlbäck, 1955). It is, thus, possible that the low representation of flippers at the castle, at the parsonage and at the friary is because the sites received the seals as tax or tithe, after the kill reward had already been taken off the animals. The Iron Age sites and also the farmstead at Eckerö had a better representation of the flippers which apparently were used by the hunter (peasant groups). This indicates that in contrast to the information in the account books from the castle, the zooarchaeological record shows that whole seal carcasses were apparently not processed for consumption in Kastelholm.

The presence of flippers in the material probably also depend on the way the seal carcass would have been processed. An 18th century academic dissertation describes that the abdomen was opened first, the hide and the blubber layer was then pulled off from other parts, except for the nose and the flippers. The head, udder and flippers were cut off when the blubber had been taken care of. The flippers were cooked with the hair still on them and salted after that (Hellbom, 1987). In the traditional tanning methods of seal skins the flippers were left in the hides when the seals were skinned but removed when the skin was prepared for suspension (Fig. 7). It is evident that the flippers probably were handled differently than the bodies of the seals. The seal hunters in Ostrobothnia during the winter hunting journeys were known to cut the blubber (and skin) off the carcasses, and taking the removed blubber and skin layer back from the hunting grounds, as the whole

carcass would have been too heavy to transport on the boats used in the hunt (e.g. Kvist, 1987).

The relatively high frequency of seal bones in Late Iron Age sites and the early modern period farmstead in Eckerö can be argued as being from settlements where seals were hunted and procured for one's own use. The friary and the parsonage, on the other hand, obtained seals through tithe which is reflected in the anatomical distribution. The low frequency of seals at the parsonage in Jomala could be a consequence of the more limited possibilities, or actually a limited need, for seal hunting in the area as land cultivation and husbandry was possible to a higher extent than in the outer archipelago island of Kökar (see Storå, 1985).

The higher frequency of seals at Kastelholm than at the parsonage probably reflects that the taxes/tithe that were collected at Kastelholm from a larger area of Åland, including the archipelago. It is also possible that the tithe on Kökar changed when the Crown took it over. The zooarchaeological assemblages from the friary suggest that the tithe was also paid in seal meat. The account books from Kastelholm, on the other hand, document mainly blubber, train oil and skins as tithe from Kökar. It is possible that the seal bones analysed from Kastelholm are from seals captured by seal hunters employed by the castle. Furthermore, the low numbers of flipper bones can be due to the 'kill' share or reward given to those seal hunters responsible for the seal's capture. This would then also explain the slight differences in the age distribution patterns of the seals from the friary and the castle.

## 5. Conclusions

Seals were an important source of meat, skins and blubber during the Iron Age and early historical period Åland. The difference in species representation between late Iron Age and the early modern period might be related to a slight change in the environmental and climatic conditions, but the results are not conclusive. The compositions of the zooarchaeological assemblages vary on different sites. The Iron Age sites and early modern period farmstead at Eckerö have relatively large quantities of seal bones, as well as flippers, compared to the medieval and early modern ecclesial and castle sites. The tithe on seals was an important income for the churches and parsonages in the medieval period as documented in the letters of the bishop. That the Crown took over the tithe, which the Franciscan friars on the island of Kökar had earlier received, shows that seal products were of high value also in the

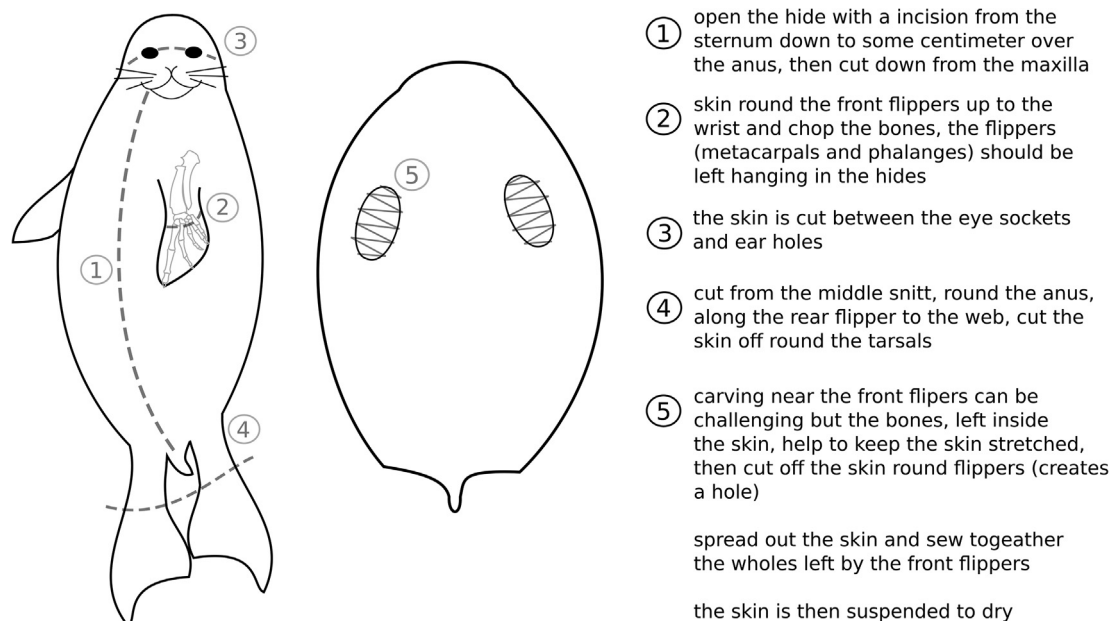


Fig. 7. The procedure of skinning the seal in order to obtain hides. Based on Salomonson and Sandström (2009).

early modern period. In addition, most seal bones from the castle come from 16th century assemblages indicating an increased importance through time. Seals were hunted almost the whole year with the exception of the designated protection periods.

The differences in anatomical representation is related to the character of the different sites. The ecclesial and castle sites obtained the seals as tithe from peasants or by provision, which could explain the almost total absence of flippers, which would likely have been presented to the hunters' as their reward for killing the seals. The seals were dismembered into parts suitable for preservation in barrels and the meat was consumed at the castle and at the friary, but it is unknown during which period of the year. Other seal products were mainly transported from Kastelholm to Stockholm. The combination of different sources have provided a more varied picture of the use of seals as some seal products are invisible in either the account books or in the zooarchaeological assemblages. The study shows the general value of incorporating different sources, when available, on the utilization of animal resources.

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